What is claimed is:

1. An apparatus capable of monitoring on-line steam quality, temperature, and pressure at the head of the injection well, composed of a bulk of three optical fiber sensors and a transducer. The head of the sensor directly enters into the specified steam pipe, preventing blockage of any steam. The transducer, installed inside the junction box at the working site, is to be utilized by several surrounding wells. A cable connection links the sensor bulk and transducer together. The invented apparatus boasts the following three functions:

a. Long-range data collection transmitted through cables, connected to a combination box.

b. Release of data at the working site, initialized by a notebook compute; connected onto a special joint of the transducer.

c. Data collection with a satellite; a data emitting antenna is connected onto a special joint of the transducer as well.

2. The bulk, as stated in claim 1, is composed of four separate blocks: high temperature and pressure, heat-emitting and temperature reducing, heat insulation, and opto-electric elements, found in a natural cooling room. The first-mentioned block is constructed of heat-resistant stainless steel. Referring to the heat-emitting block, two layers of metal piping are applied; a highly reflective coating covers the surface. In further detail, the inner pipe, filled with glass fiber cloths, guides the optical fibers. Air holes surround the outer pipe allowing steam to flow through, reducing temperature. Summing up, the heat installation block is constructed out of

polytetrafluoroethane (PFE). It is to be noticed that an air gap, 5 ~ 15 mm, purposely exists between pipes.

3. The bulk as stated in claim 1 includes the following three sensors: steam quality, temperature, and pressure. The steam quality sensor is composed of two parallel optical fibers possessing a large core, connected by a blue gem probe. The two said fibers serve separate functions; one receives light, and one emits light. When light transmitted from the blue gem probe to the LED carries a wavelength measuring near infrared, the fluid state will be disturbed, determined by the light strength. The PIN probe, connected to the light-receiving fiber, will transmit the corresponding electric signal. The signal is then amplified and rectified before entering into the transducer, where A/D transfer and pattern discrimination will be carried out. The steam pressure sensor is composed of two parallel optical fibers possessing a large core as well; rests against an elastic diaphragm; which gaps 0.5 ~ 2 mm from the optical fiber's end. When steam pressure fluctuates, the gap between the diaphragm and optical fiber is subjected to change as well, thus the PIN probe will accurately transmit the corresponding electric signal to the pressure of steam. After the aforementioned step occurs, including amplification and rectification, the signal enters into the transducer. The steam temperature sensor is composed of infrared optical fiber material. Of the optical fiber, one end is inserted into the selected steam pipe; the other connects to a thermo-electric probe. In a similar fashion, corresponding electric signals transmit simultaneously with temperature changes of the steam. The signal produced enters into the transducer, after amplification and rectification occurs.

4. Included inside the transducer, stated in claim 3, is a micro-processing unit; capable of functions such as A/D transfer, pattern discrimination, and sampler trigger. Signals ρ, t, and p, provided at the moment requested, will be relayed through long-range transmission, data release at the working site, or by satellite collection. The transducer provides a 12v or 24v direct power source for all said sensors. The direct current, to be supplied by the transducer, will be obtained from an AC transfer of 110v/220v inside the junction box, located at the working site.

5. The steam quality sensor, mentioned in claim 3, is capable of directly measuring steam quality, not obtained from conversion of temperature and pressure. A unique feature of the present invention is that the space refractive index n represents the two-phase fluid's state at a specified moment. The invented method is utilized to measure the quality of steam on-line, while maintaining a level of high accuracy.

6. The steam quality sensor, stated in claim 5, possesses a head constructed of blue or red gem; upholding a high level of endurance. The end of the above-mentioned probe takes on the shape of a semi-circle, cone, or lens. The surface of the probe's side maintains a taper of 1:10 ~ 1:50. For sealing purposes at such high temperature and pressure levels, the probe is firmly stationed onto a stainless steel stand; wall thickness is greater than 1.5 mm.

7. In addition, to resolve the stated sealing dilemma in claim 6, a red copper washer will be placed at each joint of thread. The present invention is capable of withstanding the following conditions: temperature $\leq$ 360℃ (680 °F), pressure $\leq$ 20 Mpa.